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ABSTRACT

This document presents a statistical profile of minority women in science based on unpublished 1980-81 data from the National Research Council, National Academy of Sciences, and from the Scientific Manpower Commission. Areas examined include numbers of minority scientists and engineers, academic degrees, secondary and college participation, employment rates, employment status, and salaries. Among the findings are those indicating that: (1) in 1981 there were 4,809 minority women doctoral scientists and engineers; (2) in most fields minority women are a larger percentage of new doctorates (1980-81) than they are of the existing United States doctoral population (1981); (3) 94 percent of minority women undergraduate students and 93.5 percent of graduate students are majoring in disciplines other than science or engineering (SE); (4) employment rates of SE Ph.D's show lower full-time rates and higher rates of unemployment for all minority groups when compared with those of white scientists; and in every racial and/or ethnic category men are more likely than women to be employed outside academe. It is indicated that additional studies are needed and that the scarcity of data disaggregated by race and sex makes it difficult to accurately determine current status or assess changes. (JN)

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MINORITY WOMEN IN SCIENCE - A Statistical View

The Numbers

In 1980, minority women who comprised 12% of the U.S. resident population, were 7.8% of the civilian labor force. Women who are Hispanic (Black or White), Black non-Hispanic, Asian/Pacific Islander or American Indian/Alaskan Native were in 1981 approximately 1.34% of the total science and engineering doctoral population of the United States. By contrast, in 1980, White males, who comprised 40% of the U.S. resident population, were 47.7 % of the civilian labor force. In 1981, they were 77.6% of U.S. scientists and engineers with Ph.D.'s. Although women are approximately 46.0% of the minority civilian labor force, they are only 13% of minority doctoral scientists and engineers. (Women are 17.6% of U.S. born minority Ph.D. scientists and engineers.)

In 1981, by National Research Council (NRC), National Academy of Sciences' data, there were 4,809 minority women doctoral scientists and engineers (U.S. citizens and foreign citizens with permanent visas). This represents 1.34% of the total population of 358,600 doctoral scientists and engineers. (This total includes 3,664 foreign citizens with temporary visas.) The estimated numbers and percentages of minority women doctoral scientists and engineers (excluding foreign citizens with temporary resident status) are 550 Hispanic (0.15%), 1,057 Black, non-Hispanic (0.30%), 2,895 Asian/Pacific Islander (0.81%), and 307 American Indian/Alaskan Native (0.09%). When the numbers of minority women doctoral scientists and engineers are aggregated, Asian/Pacific Island women comprise 60.20%, Black, non-Hispanic women 21.98%, Hispanic women 11.44% and American Indian/Alaskan Native women 6.38% of the total 4,809. NRC data (1979) suggest that circumstances for Asians in the U.S. may be less conducive to pursuit of science education and careers than is commonly thought, since 92% of Asian Ph.D. scientists and engineers in this country are foreign born.

In most fields minority women are a larger percentage of new doctorates (1980-81) than they are of the existing U.S. doctoral population (1981). Considerable gains appear in engineering, the social sciences and psychology, but in the other fields the difference was less than 1%. The percentage of minority women among new doctorates was less than their percentage in the doctoral population in the physical sciences, computer science and biological sciences, as indicated in Table 1. At the master's and bachelor's degree levels the proportion of degrees conferred to minority women (1980-81), though somewhat higher than that at the doctoral level, is far from sufficient to bridge the gap at either degree level within the next five years. These figures, predict that minority women will comprise a decreasing proportion of U.S. doctoral scientists and engineers in the physical sciences, computer science and engineering. Table 2 gives the numbers and percentages of 1981 doctoral recipicients by field, gender, and racial/ethinic group.

Table 1
Percentage of
Black, Hispanic, Asian/Pacific Islander and American Indian/Alaskan Native Women
by Field Among Degree Recipients, 1980-81

	Bachelor's	Master's	Ph.D.	Among 1981 US Doctoral Scientists & Engineers*
Engineering	1.27	1.07	0.43	0.19
Biological Sciences	5.88	3.52	2.37	2.39
Mathematics	5.02	3.00	1.84	1.38
Computer Science	5.05	2.83	.00	0.61
Physical Sciences	2.53	1.49	0.73	1.05
Psychology	9.20	5.29	3.48	1.89
Social Sciences	8.75	4.24	2.43	1.36

*Based on weighted samples

Source: NRC, unpublished data

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Table 2
DOCTORATE RECIPIENTS, 1981 U.S. CITIZENS: Racial/Ethnic Group

FIELDS	Total	Female	White		American Indian		Asian		Black		Mexican American		Puerto Rican		Other Hispanic	
			T	F	T	F	T	F	T	F	T	F	T	F	T	F
All Fields	26,262	8,673	22,400	7,490	89	31	1,062	149	1,104	512	161	52	115	58	249	79
% of Total	100.0	33.0	85.3	28.5	0.34	0.12	4.0	0.57	4.2	1.9	0.61	0.2	0.44	0.22	0.95	0.3
Math	523	74	446	70	1	0	40	6	9	1	2	0	2	1	3	0
% of Vertical	2.0	0.85	2.0	0.93	1.1	0.0	3.8	4.0	0.82	0.2	1.2	0.0	1.7	1.7	1.2	0.0
% of Horizontal	100.0	14.15	85.28	13.38	0.19	0.0	7.65	1.15	1.72	0.19	0.38	0.0	0.38	0.19	0.57	0.0
Computer Science	188	30	162	18	0	0	16	1	2	1	0	0	0	0	0	0
% of Vertical	0.7	0.2	0.72	0.24	0.0	0.0	1.5	0.67	0.18	0.2	0.0	0.0	0.0	0.0	0.0	0.0
% of Horizontal	100.0	10.64	82.16	4.82	0.0	0.0	8.51	0.53	1.06	0.53	0.0	0.0	0.0	0.0	0.0	0.0
Physics and Astronomy	768	45	631	37	0	0	55	1	6	1	0	0	3	0	5	0
% of Vertical	2.9	0.52	2.8	0.5	0.0	0.0	5.2	0.67	0.54	0.2	0.0	0.0	2.6	0.0	2.0	0.0
% of Horizontal	100.0	5.86	86.17	9.57	0.0	0.0	7.16	0.13	0.78	0.13	0.0	0.0	0.39	0.0	0.65	0.0
Chemistry	1,326	178	1,121	163	1	0	91	3	18	2	3	0	7	3	12	1
% of Vertical	5.0	2.1	5.0	2.2	1.1	0.0	8.6	2.0	1.6	0.39	1.9	0.0	6.1	5.2	4.8	1.3
% of Horizontal	100.0	13.42	84.54	12.29	0.08	0.0	6.86	0.23	1.36	0.15	0.23	0.0	0.53	0.23	0.90	0.08
Earth, Environmental and Marine Science	486	47	447	45	0	0	12	1	4	0	0	0	2	0	4	0
% of Vertical	1.8	0.54	2.0	0.6	0.0	0.0	1.1	0.67	0.36	0.0	0.0	0.0	1.7	0.0	1.6	0.0
% of Horizontal	100.0	9.67	91.98	9.26	0.0	0.0	2.47	0.20	0.82	0.0	0.0	0.0	0.41	0.0	0.82	0.0
Engineering	1,467	53	1,092	43	4	0	282	6	19	0	2	0	5	0	9	0
% of Vertical	5.6	0.6	4.9	0.57	4.5	0.0	26.6	4.0	1.7	0.0	1.2	0.0	4.3	0.0	3.6	0.0
% of Horizontal	100.0	3.61	74.44	2.93	0.27	0.0	19.2	0.41	1.30	0.0	0.14	0.0	0.34	0.0	0.61	0.0
Biological Science	3,058	859	2,691	759	6	1	136	26	47	25	11	1	6	3	22	5
% of Vertical	11.6	9.9	12.0	10.1	6.7	3.2	12.8	17.4	4.3	4.9	6.8	1.9	5.2	5.2	8.8	6.3
% of Horizontal	100.0	1.15	88.00	24.82	0.20	0.03	4.45	0.85	1.54	0.82	0.36	0.03	0.20	0.10	0.72	0.16
Agricultural Science	731	96	635	91	2	0	29	3	18	0	3	0	2	0	11	0
% of Vertical	2.8	1.1	2.8	1.2	2.2	0.0	2.7	2.0	1.6	0.0	1.9	0.0	1.7	0.0	4.4	0.0
% of Horizontal	100.0	13.13	86.87	12.45	0.27	0.0	3.97	0.41	2.46	0.0	0.41	0.0	0.27	0.0	1.50	0.0
Medical Science	802	265	695	235	3	1	47	7	15	8	1	1	2	2	3	1
% of Vertical	3.1	3.1	3.1	3.1	3.4	3.2	4.4	4.7	13.6	1.6	0.62	1.9	1.7	3.4	1.2	1.3
% of Horizontal	100.0	33.04	86.66	29.30	0.37	0.12	5.86	0.87	1.87	1.00	0.12	0.12	0.25	0.25	1.2	1.3
Social Science (including Psych.)	5,662	2,078	4,960	1,845	14	6	135	31	223	101	45	10	16	10	61	20
% of Vertical	21.6	24.0	22.1	24.6	15.7	19.4	12.7	20.8	20.2	19.7	28.0	19.2	13.9	17.2	24.5	25.3
% of Horizontal	100.0	36.7	87.6	32.58	0.25	0.10	2.38	0.55	3.94	1.78	0.79	0.18	0.28	0.18	1.08	0.35
*Psychology	3,153	1,361	2,841	1,218	10	5	41	17	113	64	25	6	8	7	33	16
% of Vertical	12.0	15.7	11.3	16.3	11.2	16.1	3.9	11.4	10.2	12.5	15.5	11.5	6.9	12.1	13.3	20.3
% of Horizontal	100.0	43.16	90.10	38.63	0.32	0.16	1.30	0.54	3.58	2.03	0.79	0.19	0.25	0.22	1.05	0.51
All Science & Engineering	15,011	3,647	12,8809	3,306	31	8	843	85	361	139	65	12	45	19	130	27
% of Total for Group	57.2	42.1	57.5	44.1	34.8	25.8	79.4	57.0	32.7	27.1	40.4	23.1	39.1	32.8	52.2	34.2

*Does not count in total

NOTE: Horizontal totals are less than 100% because of the "other and unknown" column (N=1082) which is omitted from this table.

Source: NRC, unpublished data

The Pipeline

In Fall 1980 minority women were 9.8% of total undergraduate enrollments in U.S. colleges and universities. They were 5.25% of graduate enrollments. Combining undergraduate and graduate students, minority women comprised 9.5%. Their numbers within science and engineering departments vary both across fields and by academic level. For example, minority women were 10.27% of undergraduate, 3.52% of graduate and 9.5% of all students in the biological sciences. In the physical sciences minority women were 4.04% of undergraduate majors and 1.5% of graduate students. In engineering the figures were 2.4% of undergraduate students and 0.87% of graduate students. This means that 94% of minority women undergraduate students and 93.5% of graduate students are majoring in disciplines other than engineering, the biological or physical sciences. Given the distribution of jobs in the U.S. labor force, this is a far from acceptable field distribution for minority women who pursue higher education.

A recent study of high school seniors by the National Center for Education Statistics (NCES) (Table 3) found that roughly equal percentages of males and females reported taking one year of mathematics (94% and 92% respectively) and science courses (91% and 89% respectively). Only 28% of females and 40% of males reported taking three years or more of mathematics. At the same time 19% of females and 27% of males reported taking three years or more of science. Few young men and even fewer women take the specific science and mathematics courses in high school that they would need to become science, mathematics or engineering majors in college.

Table 3
Percentage of 1980 High School Seniors Taking Specific Mathematics and Science Courses by Sex and Course Title

Course	All Seniors	Male	Female
Algebra I	79	79	79
Algebra II	49	51	47
Geometry	56	58	55
Trigonometry	26	30	22
Calculus	8	10	6
Physics	19	26	14
Chemistry	37	39	35

Source: NCES, High School and Beyond

In the NCES study, High School and Beyond, we find that 33% of white students, 35% of Black students, 27% of Hispanic students and 22% of American Indian students report taking three years or more of mathematics. At the same time, 23% of White students, 19% of Black students, 14% of Hispanic students and 12% of American Indian students report taking three years or more of science. While we lack data on which courses comprise the "three or more years" of mathematics taken by minority students, it is evident from Table 4 that few are taking college preparatory courses in mathematics and science.

Table 4
Percentage of 1980 High School Seniors Taking Mathematics and Science Courses by Course Title and Racial/Ethnic Group

Course	Racial Ethnic Group: Hispanic	Black	White	American Indian	Asian or Pacific Islander
Algebra I	67	68	81	61	88
Algebra II	38	39	50	32	76
Geometry	39	38	60	34	79
Trigonometry	15	15	27	17	50
Calculus	4	5	8	5	22
Physics	15	19	20	17	35
Chemistry	26	28	39	24	59

Source: NCES, High School and Beyond

Although the numbers of minority female students within each category cannot be discerned and are not yet available, we can speculate that they too are underrepresented in college preparatory mathematics and science courses.

The Status of Minority Women Doctoral Scientists

Employment rates of science and engineering Ph.D.'s show lower full-time employment rates and higher rates of unemployment for all minority groups when compared with those of White scientists. Women of all races have higher withdrawal and unemployment rates than men, as shown in the Table 5 below.

Table 5
Withdrawal* and Unemployment Rates for Science and Engineering Ph.D.s by Sex and Racial/Ethnic Category

	Science/Engineering: US-Born Whites	US-Born Minorities	Foreign-Born Minorities
Men, Total Population	224,614	5,826	18,991
Withdrawal Rates	0.6	0.9	0.7
Women, Total Population	28,161	1,244	2,191
Withdrawal Rates	5.1	2.7	4.3
Men, Labor Force	215,174	5,608	18,735
Unemployment Rate	0.6	2.1	0.8
Women, Labor Force	25,422	1,184	2,051
Unemployment Rate	2.7	2.7	3.8

*Percent withdrawn is the percentage of the population who are unemployed and no longer seeking employment, whereas the unemployment rate is the percentage of the labor force unemployed and seeking employment.

Source: NRC, Employment of Minority Ph.D.'s: Changes Over Time

Table 6 shows that U.S. born Black scientists and engineers are less likely than any other group to be employed full time or hold postdoctoral appointments, and are more likely than White or other minority scientists and engineers to be employed part-time or unemployed. Asian scientists have the highest employment rate and lowest unemployment rate of any U.S. born minorities. Hispanics are more likely than any other group to hold postdoctoral appointments.

Table 6
Employment Status of Science and Engineering Ph.D.'s in the U.S. Labor Force*

Employment Status	Total	US-Born Whites	US-Born Minorities				Foreign-Born Minorities
			Total+	Hispanic	Black	Asian	
Total Labor Force	308,819	240,586	6,792	1,585	2,683	1,725	20,786
Percentage of:							
Full-Time Employed	92.4	92.6	89.6	87.5	88.7	90.3	92.5
Part-Time Employed	3.3	3.4	3.3	2.3	5.7	1.4	1.4
Postdoctoral Appt.	3.3	3.2	4.9	8.5	2.0	7.4	5.0
Unemployed, Seeking	1.0	0.8	2.2	1.7	3.6	0.9	1.1

* The labor force is the sum of full- and part-time employed, the unemployed who are seeking work, and Ph.D.'s on postdoctoral appointments.

+ Includes American Indians.

Source: NRC, Employment of Minority Ph.D.'s: Changes Over Time

Minority scientists and engineers are more likely than are their White counterparts to be employed in academe and within each group (minority and non-minority) women are more likely than men to hold academic appointments. The proportion of science and engineering Ph.D.'s employed in academe has declined about 6% for all groups in the past 42 years.

Quoting Employment of Minority Ph.D.'s: Changes Over Time, ". . . the percentages of academically employed 1960-1978 Ph.D.'s in science and engineering who were tenured in 1979 were similar across racial/ethnic groups, with 61 percent for U.S.-born whites, 57 percent for U.S.-born minorities and 62 percent for foreign-born minorities. The notable exceptions were U.S.-born black Ph.D.'s, only 45 percent of whom had achieved tenure and foreign-born Hispanics, with 43 percent in tenured positions." Fewer Black scientists and engineers (18.9%), had the rank of professor than did any other group. In other groups the percentage of full professors ranged from 22.3% for Hispanics to 37.8% for foreign-born Whites. More Blacks (12.0%) than other scientists listed their rank as "other" than professor, associate professor, assistant professor or instructor. (Four percent of Asians and 9.8% of foreign-born Whites had "other" ranks.)

In every racial/ethnic category men are more likely than women to be employed outside academe. The overall percentages are 39.3% of women and 47.7% of men. For most U.S.-born non academic scientists and engineers, business and industry is the most frequent employer. Black Ph.D.'s are the only exception, with 33.4% employed by the U.S. government and 30.3% by business and industry.

Salary figures are obviously influenced by field of doctorate and academic rank. In each instance the concentration of minority scientists in lower paying fields and at lower ranks affected salary data. With the exception of Asian life scientists, minority scientists had a somewhat lower median annual salary than did U.S. or foreign born Whites in each field of doctorate. In both academic and non-academic employment, regardless of race/ethnic group, men had a higher median annual salary than did women. "In all cases . . . median salaries for male Ph.D.'s employed in nonacademic jobs were much higher than those for women. The difference between male and female salaries of U.S.-born minorities was over 25%, the largest of all."

Implications

The scarcity of data disaggregated by race and gender makes it difficult to accurately determine current status or assess changes. The most detailed data are available on the doctoral population, and are collected by the National Research Council. In a few disciplines, the professional societies, notably the American Chemical Society and the American Institute of Physics collect detailed statistics on scientists at all degree levels. Since the data are collected in most instances by race and gender, it would be helpful for research and monitoring if disaggregated figures were available, even if not published.

Availability of accurate numbers is important. However, the evidence already available makes it apparent that most minority women scientists and engineers are not achieving status (as indicated by salaries, rank or position and representation within the leadership of their disciplines) appropriate for their levels of education and experience. It is clear that the pool of minority women scientists and engineers is diminishing at a time when there should be real growth. An examination of course-taking and achievement at precollege levels reveals that minority girls are not getting the elementary and secondary education needed to prepare them for higher education in the sciences.

The magnitude of the problem demands a massive effort by a variety of institutions and individuals. While the efforts of the National Network of Minority Women in Science are focussed on this population, it is imperative that other groups addressing the needs of the entire population or larger segments thereof, actively include minority women and girls in the initiatives that develop.

Sources

This paper was developed with unpublished data from the National Research Council, National Academy of Sciences and from the Scientific Manpower Commission. Primary published sources are

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